The limits of x are $ny=x_2$ and $n(c-y)=x_1$; of y, 0 and $\frac{1}{2}c$.

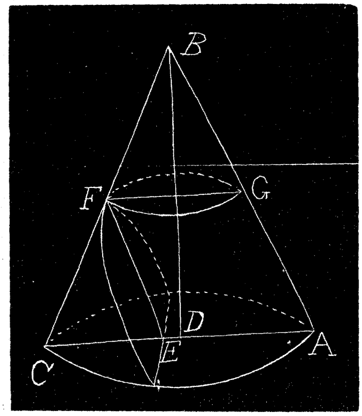
$$\therefore\ V=2\int_0^{\frac{1}{2}c}\int_{x_2}^{x_1}\sqrt{[n^2(c-y)^2-x^2]}dydx$$

$$=\int_0^{\frac{1}{2}c}\{\tfrac{1}{2}\pi n^2(c-y)^2-n^2(c-y)^2\sin^{-1}\left(\frac{y}{c-y}\right)$$

$$-ny\sqrt{[n^2(c-y)^2-n^2y^2]}\}dy$$

$$=\tfrac{1}{6}\pi n^2c^3-\tfrac{2}{9}n^2c^3=\tfrac{1}{18}n^2c^3(3\pi-4)$$

$$=\tfrac{1}{18}R^2c(3\pi-4).$$



But $c=12$, $R=4$.

$\therefore\ V=32\pi-\frac{128}{3}$.

Volume of cone$=\frac{1}{3}\pi R^2c=64\pi$.

$\therefore$ Required vol.$=64\pi-(32\pi-\frac{128}{3})=32\pi+\frac{128}{3}$

$=143.1978$ cubic feet,

$=115.07$ bushels.

Also solved by *P. S. BERG* and *C. C. CROSS*.

[NOTE.—In the figure, the point E should coincide with D. ED. F.]

65. Proposed by F. P. MATZ, D. Sc., Ph. D., Professor of Mathematics and Astronomy, Irving College, Mechanicsburg, Pa.

Show that the path of a projectile moving with a constant velocity is an inverted catenary of equal strength.

No solution has yet been received.

PROBLEMS FOR SOLUTION.

ARITHMETIC.

102. Proposed by ALOIS F. KOVARIK, Professor of Mathematics, Decorah Institute, Decorah, Iowa.

A's age is to B's as 2:3. 20 years from now their ages will be to each other as 4:5. What are their ages, respectively ?

103. Proposed by WALTER H. DRANE, Graduate Student, Harvard University, 65 Hammond Street, Cambridge, Mass.

Find proceeds of a note discounted at a bank for 10 years at 10%. What is the meaning of the result ?

*** Solutions of these problems should be sent to B. F. Finkel not later than January 10.

ALGEBRA.

92. Proposed by ELMER SCHUYLER, High Bridge, N. J.

Given $x^2-yz=1$; $y^2-xz=2$; $z^2-xy=3$. Find x, y, and z.

93. **Proposed by CHARLES CARROLL CROSS, Libertytown, Md.**

Given $x^x+y^y=285$, and $y^x-x^y=14$, to find the values of x and y. [From *Bonnycastle's Algebra*, 1841.]

⁂ Solutions of these problems should be sent to J. M. Colaw not later than January 10.

GEOMETRY.

108. **Proposed by NELSON L. RORAY, Bridgeton, N. J.**

ABC is a triangle. O_1, O_2, O_3 centers of escribed circles. Prove altitudes of triangle $O_1O_2O_3$ are concurrent at center of inscribed circle.

109. **Proposed by CHARLES CARROLL CROSS, Libertytown, Md.**

Two circles, radii in ratio 3:1, centers A and O_1 respectively, are drawn tangent externally to each other and internally to a given circle O, and on the same diameter ; O_2 and O_2' are drawn tangent internally to O and externally to A and O_1 ; O_3 and O_3' are drawn tangent internally to O and externally to A and O_2 ; O_3 and O_3' are drawn tangent internally to O and externally to A and O_2, A and O_2', respectively ; and so on. Prove O_4, O, O_4' ; O_5, A, O_5' ; O_9, A, O_3' and O_{10}, O, O_2' are collinear. [The letters apply to the centers of the circles.]

110. **Proposed by P. S. BERG, A. M., Principal of Schools, Larimore, N. D.**

If the three face angles of the vertical triedral angle of a tetraedron are right angles, and the lengths of the lateral edges are represented by a, b, and c, and of the altitude by p, then $1/p^2=1/a^2+1/b^2+1/c^2$. [*Chauvenet's Geometry.*]

⁂ Solutions of these problems should be sent to B. F. Finkel not later than January 10.

CALCULUS.

83. **Proposed by J. SCHEFFER, A. M., Hagerstown, Md.**

From a given point, P, in the base AB of a triangle, to inscribe in the latter the minimum triangle, if its angle at P is given.

84. **Proposed by C. HORNUNG, A. M., Professor of Mathematics, Heidelberg University, Tiffin, Ohio.**

Find the equation of the curve upon which a given ellipse must roll in order that one of its foci may describe a straight line.

⁂ Solutions of these problems should be sent to J. M. Colaw not later than January 10.

MECHANICS.

77. **Proposed by ELMER SCHUYLER, High Bridge, N. J.**

At what elevation must a shell be projected with a velocity of 400 feet that it may range 7500 feet on a plane which descends at an angle of 30°?

78. **Proposed by ALOIS F. KOVARIK, Professor of Mathematics, Decorah Institute, Decorah, Iowa.**

A cone and a cylinder having equal heights and equal circular bases are filled with